

NIMS Precision Machining Academic Standards Crosswalk

**A Companion Document to the
NIMS Precision Machining
Statewide Approved Course Outline**

(Matched to the California Academic Content Standards)

**California Department of Education
ROCP Unit**

FOREWORD

The **NIMS Precision Machining Academic Standards Crosswalk** (Crosswalk) is a companion document to the statewide approved course outline “NIMS Precision Machining” available online at <http://www.cde.ca.gov/ci/ct/rp/documents/nims.pdf>. Ron Cassel, Los Gatos, California, under the leadership of Orville Buesing, California Department of Education, Regional Occupational Centers and Programs Unit, developed the Crosswalk.

The Crosswalk was developed for classroom teachers, administrators, curriculum developers, and others to employ in the integration of “NIMS Precision Machining” standards with California’s academic content standards. Academic standards linked to the *California High School Exit Examination* are a noted feature of the Crosswalk. Page numbers of the standards are referenced in abbreviated form. The standards referenced are provided in full at the end of this document.

The Crosswalk is intended to be a useful curriculum planning tool. Users should feel free to apply, adapt and/or adopt the Crosswalk and Crosswalk elements to meet individual program needs. User comments are welcome and will be incorporated as necessary in future drafts of this evolving resource. Comments may be e-mailed to obuesing@cde.ca.gov and/or rdahl@cde.ca.gov.

NIMS Precision Machining Standards Crosswalk

1.0 Content Competencies – Level I

1.1 Module 1 – Task Planning and Management: Designed to allow the student hands-on skill advancement in task planning and management. Emphasis will be on process planning for a part and all work necessary to produce route and process sheets.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	History / Social Science Standards
1.1.1 Task Process Planning - Develop a process plan for a part requiring milling, drilling, turning, or grinding. Complete an operation sheet detailing the process plan and required speeds, feeds, depth of cuts, etc.	EW1.3 p44; ER2.5 p50 EWA2.6a p52; EWO1.6 p53; EW1.5 p59 EW2.3d p60; EW2.3f p60 EW2.6a p61; EW2.6b p61 ESA 2.2f p64; EWA2.1c p70; EWA2.4a p70; EWO1.2 p72; ELSS1.8c p73; ESA2.3c p74	MNS1.2 p29; MNS1.3 p29; MMG1.2 p32; MMG2.4 p32; MMG3.1 p32; MMG1.1 p34; MMR2.1 p34; MMR2.8 p34; MA3.0 p38; MA5.0 p38; MA13.0 p39	SPS1c p26; SPS2d p27; SPS3f p27	N/A

Note: Boldface type indicates those standards proposed for assessment on the *California High School Exit Examination*.

N/A: None associated

2.0 Content Competencies – Level I

2.1 Module 2 – Manual Operations - Bench metal: Designed to provide basic skills needed for using hand tools and performing bench metal work. Included is the use of arbor presses, work holding and hand tools, hacksaws, files, reamers, taps and dies, finishing tools, bushings, bearings, and assembly tools.

Manual Operations – Layout: Designed to provide basic skills for layout hole locations, radii, and surfaces to match the drawing and specifications. The student is required to perform all work necessary to produce the part given the raw material, drawing, process plan, layout tools and measuring instruments.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
2.1.1 Bench work: Tap holes. Use files, scrapers, and coated abrasives to deburr parts. Use arbor presses to perform interference fits. Use bench vises and hand tools appropriately.	ER2.5 p50; EWA2.6a p52; ER2.6 p57; EW1.5 p59; EW2.3f p60; EW2.6a – 2.6b p61; ESA2.2f p64; EW1.5 p69; EWA2.1c & 2.1e p70; EWO1.2 p 72; ELSS1.8c p73	MNS1.2 p29; MNS1.3 p29; MMG1.2 p32;	SPS2d p27; SPS3f p27; SP1d p31; SIE1b & c p52; SIE1L p52	SSH10.3.2 p43; SSH11.2.5 p48
2.1.2 Layout: Layout the location of hole centers and surfaces with an accuracy of +/- .015.	EW1.3 p44; ESA2.3 p48; EWA2.6a p52; EW2.3f p60; EW2.6a & b p61; ESA2.2d & f p64; ELSS1.8c p73	MNS1.2 P29; MNS1.3 P29; MMG1.1 p32; MMG1.2 p32; MMG2.4 p32; MMG3.1 p32; MMR2.8 p 34; MA3.0 p38;	N/A	SSH10.3.2 p43; SSH11.2.5 p48

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N/A: None associated

3.0 Content Competencies – Level I

3.1 Module 3 – Turning Operations: Designed to provide basic skills needed for operating standard engine lathes. Given access to an appropriate turning machine and accessories, raw material, process plan, drawing, and precision measurement and cutting tools, the student produces a part. The student is required to perform all necessary practices.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
3.1.1 Between Centers Turning – Set up and perform straight turning operations between centers.	EW1.3 p44; ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57; EW1.5 p59; EW2.3f p60; EW2.6a & b p61; EWA2.1c & e p70; EWO1.2 p72; ELSS1.8c p 73; ESA2.3c p74	MNS1.2 p29; MNS1.3 p29; MAF1.5 p30; MMG1.2 p32; MMR2.1 p34; MMR2.8 p34; MA3.0 p38; MA5.0 p38;	SPS1c p26; SPS1f p26; SPS2d p27; SP1d & g p31; SIE1c – p52; SIE1L – p52	SSGH8.12.9 p39; SSH10.3.2 p43
3.1.2 Chucking – Set up and perform chucking operations for turning.	EW1.3 p44; ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57; EW1.5 p59; EW2.3f p60; EW2.6a & b p61; EWA2.1c & e p70; EWO1.2 p72; ELSS1.8c p 73; ESA2.3c p74	MNS1.2 p29; MNS1.3 p29; MAF1.5 p30; MMG1.2 p32; MMR2.1 p34; MMR2.8 p34; MA3.0 p38; MA5.0 p38;	SPS1c p26; SPS1f p26; SPS2d p27; SP1d & g p31; SIE1c – p52; SIE1L – p52	SSGH8.12.9 p39; SSH10.3.2 p43

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N/A: None associated

4.0 Content Competencies – Level I

4.1 Module 4 – Milling Operations: Designed to provide basic skills needed for operating standard vertical and horizontal milling machines. The student is required to perform all work to produce a part given raw the material, process plan, drawing, tooling, and measurement instruments.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
4.1.1 Power Feed Milling - Setup and operate a horizontal or vertical milling machine using power speeds and feeds, depth of cuts and coolant needs. Perform routine milling.	ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57 EW2.3f p60; EW2.6a & b p61; ESA2.2f p64; EWO1.2 p72 ELSS1.8c p 73; ESA2.3c p74	MNS1.2 p29; MNS1.3 p29; MMG1.2 p32; MMG3.1 p32; MMR2.1 p34; MMR2.8 p34; MMR3.3 p34; MA3.0 p38; MA5.0 p38; MA13.0 p39;	SPS1c & f p26; SPS2d p 27; SP1d p31 SIE1L – p52	SSGH8.12.9 p39; SSH10.3.2 p43; SSE12.2.8 p59
4.1.2 Vertical Milling – Setup and operate vertical milling machines. Perform routine milling, and location of holes centers within +/- .005".	ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57 EW2.3f p60; EW2.6a & b p61; EL1.7 p63 ESA2.2f p64; EWO1.2 p72 ELSS1.8c p 73; ESA2.3c p74	MNS1.2 p29; MNS1.3 p29; MMG1.2 p32; MMG3.1 p32; MMR2.1 p34; MMR2.8 p34; MMR3.3 p34; MA3.0 p38; MA5.0 p38; MA13.0 p39;	SPS1c & f p26; SPS2d p 27; SP1d p31 SIE1L – p52	SSGH8.12.9 p39; SSH10.3.2 p43; SSE12.2.8 p59

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N/A: None associated

5.0 Content Competencies – Level I

5.1 Module 5 – Surface Grinding Operations: Designed to introduce the basic operations of a standard surface grinder. The student is required to (1) select, mount, and dress a grinding wheel and (2) produce a part given a block squared on a mill, a process plan, drawing, and hand and precision measuring tools.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
5.1.1 Grinding Wheel Safety – Ring test grinding wheels, perform visual safety inspection, mount and dress a grinding wheel in preparation for surface grinding.	ESA2.3 p48; ER2.2 p 49; ER2.5 p50; ER2.6 p57; EW2.3f p60; EW2.6a & b p61 ESA2.2f p64; EWA2.1c & e p70; EWA2.3c p70; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74	N/A	SPS1c p26; SPS3f p27; SPT7c p29; SIE1L p52	N/A
5.1.2 Horizontal Spindle, Reciprocating Table – Set up and operate manual surface grinders with a 10" and smaller diameter wheel. Perform routine surface grinding, location of surfaces, and squaring of surfaces. Perform wheel dressing.	ESA2.1 p48; ER2.5 EW2.3f p60; EW2.6a & b p61; ESA2.2f p64; ER2.3 p66; EWA2.1c & e p70; EWS2.3c p70; EWO1.2 p72; ELSS1.8c p73; ESA2, 1a p74	MNS1.2 p29; MNS1.3 p29; MMG1.2 p32; MA13.0 p39; MG9.0 p42;	SPS1f p26; SPSS2d p27; SIE1L p52	N/A

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N/A: None associated

6.0 Content Competencies – Level I

6.1 Module 6 – Drill Press and Power Saw Operations: Designed to introduce the basic operation of standard hand and power feed presses. The student is required to produce a part given the raw material, process plan, drawing, tooling, and measuring instruments.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
6.1.1 Drill Press – Set up and operate drill presses. Perform routine drill press operations.	ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57; EW1.5 p59; EW2.3f p60; EW2.6a & b p61; ESA2.2f p64; EWA2.1c & e p70; EWI1.2 p72; ELSS1.8c p73	MNS1.2 p29; MNS1.3 p29; MMG1.2 p32; MMG2.4 p32; MMG3.1 p32; MG20.0 p43;	SPS1c p26; SPS2d p27; SIE1c p52	N/A
6.1.2 Power Saw – Set up and operate power saws for cutoff operations.	ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57; EW1.5 p59; EW2.3f p60; EW2.6a & b p61; ESA2.2f p64; EWA2.1c & e p70; EWI1.2 p72; ELSS1.8c p73	MNS1.2 p29; MMG1.2 p32;	SPS2d p27; SIE1c p52	N/A

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N/A: None associated

7.0 Content Competencies – Level I

7.1 Module 7 – Quality Control, Inspection, and Process Adjustment: Designed to provide skills needed for basic inspection of machined parts and the process control, adjustment, and improvement of the machining processes used to manufacture those parts. Emphasis will be on teamwork, quality control, and continual improvement. All participants will be required to work as team members and prove or disprove their suggestions.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
7.1.1 Part Inspection - Develop an inspection plan and inspect simple parts using precision tools and practices. Prepare reports on the compliance of the parts.	ESA2.3 p48; EW1.5 p59; EW2.3f p60; EW2.6a & b p61; ESA2.2d & f p64; ELSS1.8c p73	MNS1.2 p29; MNS1.3 p29; MAF1.1 p30; MAF3.2 p31; MMG1.1 p32; MMG1.2 p32; MMG3.1 p32; MMG3.3 p33; MMG1.1 p34; MMR2.1 p34; MMR2.8 p34	SIE1b p52; SIE1c p52	N/A
7.1.2 Process Plan – Follow a sampling plan. Inspect the samples for the required data. Enter the data on appropriate charts. Graph the data. Respond to the warning conditions indicated by the process charts.	ESA2.3 p48; EWA2.6a p52 ER2.6 p57; EW2.3d p60; EW2.3f p60; EW2.6a & b – p61; EL1.7 p63; ESA2.2d & f p64; EWO1.2 p72; ELSS1.8c p73; ESA2.3c p74; ESA2.4a p75	MNS1.2 p29; MNS1.3p29; MAF1.5 p30; MMG1.1 p32; MMG1.2 p32; MMG3.1 p32; MMG3.5 p33; MMR2.1 p34; MMR3.3 p34; MA13.0 p39; MG15.0 p43	SPS1c p26; SPS1f p26; SIE1c p52	N/A

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7.1.3 Participation in Process Improvement – Analyze the performance of a production process as a member of a process team. The team shall formulate process adjustments for improvements where appropriate, notify the supervisor of the proposed adjustments and/or improvements. Where authorized, perform the strategies for process adjustment and/or improvement.	ESA2.3 p48; EWA2.6a p52 EW1.5 p59; EW2.3f p60; EW2.6a & b p61; ESA2.2f p64; ER2.3 p66; EW1.6 p69; EWA2.1c p70; EWA2.4a p70; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74; ESA2.3c p74	MNS1.2 p29; MNS1.3 p29; MAF1.1 p30; MAF3.2 p31; MMG1.1 p32; MMG1.2 p32; MMG3.1 p32; MMG3.3 p33; MMG1.1 p34; MMR2.1 p34; MMR2.8 p34; MMR3.3 p34; MG15.0 p43	SIE1b p52; SIE1c p52	N/A
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N/A: None associated

8.0 Content Competencies – Level I

8.1 Module 8 – General Maintenance: An introduction to all issues involved in the general housekeeping, preventive maintenance, and tooling maintenance in the metalworking field. Demonstration of appropriate actions regarding bench work and layout areas, conventional lathe areas, computer numerical control (CNC) machine areas, and the general facility is required. Specific maintenance of machines and tooling will be required along with preventive maintenance procedures.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
8.1.1 General Housekeeping and Maintenance – Keep tools, workstations, workbenches, and manual equipment clean, safe and maintain upkeep.	ESA2.3 p48; ER2.2 p49; ER2.6 p57; EW2.3f p60; EW2.6a p61; ESA2.2f p64; EER2.3 p66; EW1.5 p69; EWA2.1c p70; ELSS1.8c p73; ESA2.1a p74; ESA2.3c p74	N/A	SPS3f p27	N/A
8.1.2 Preventive Maintenance, Machine Tools – Inspect and assess the general condition of an assigned machine tool. Make routine adjustments as necessary and as authorized. Report problems to supervision that are beyond the scope of authority. Perform daily, weekly, and/or monthly routine upkeep chores cited on checklists for a given machine tool.	ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57; EW1.5 p59; EW2.3f p60; EW2.6a & b p61; ESA2.2f p64; EWA2.1e p70; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74; ESA2.3c p74	N/A	N/A	N/A

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8.1.3 Tooling Maintenance – Inspect and assess the condition of tooling. Refurbish tooling where appropriate. Refer tooling for repair or regrind where appropriate.	ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57; EW1.5 p59; EW2.3f p60; EW2.6a & b p61; ESA2.2f p64; EWA2.1e p70; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74; ESA2.3c p74	N/A	SIE1c p52	N/A
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N/A: None associated

9.0 Content Competencies – Level I

9.1 Module 9 – Industrial Safety and Environmental Protection: Designed to introduce safety procedures for the handling of work materials, operation of machines and tooling, and the handling and storage of hazardous wastes. The student is required to demonstrate safe workplace practices given written and oral instructions.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
9.1.1 Machine Operations and Material Handling – Perform assigned responsibilities while adhering to safe practices in accord with Occupational Safety Health Administration (OSHA) requirements and guidelines. Document safety activities as required.	ESA2.3 p48; ER2.2 p49; EWA2.6a p52; EW1.5 p59 ; EW2.3d p60; EW2.3f p60 ; EW2.6a p61 ; EL1.7 p63; ESA2.2d & f p64; ER2.3 p66; EWA2.1e p70; EWA2.3c p70; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74	N/A	SPS3f p27	SSH11.2.1 p48; SSH11.8.7 p51; SSE12.2.7 p59; SE12.3.1 p60
9.1.2 Hazardous Materials Handling and Storage – Handle and store hazardous materials as assigned while adhering to safe practices in accordance with OSHA and U.S. Environmental Protection Agency (EPA) requirements and guidelines. Document safety activities as required.	ESA2.3 p48; ER2.2 p49; EWA2.6a p52; EW1.5 p59 ; EW2.3d p60; EW2.3f p60 ; EW2.6a p61 ; EL1.7 p63; ESA2.2d & f p64; ER2.3 p66; EWA2.1e p70; EWA2.3c p70; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74	N/A	SPS3f p27	SSH11.2.1 p48; SSH11.8.7 p51; SSE12.2.7 p59; SSE12.3.1 p60

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N/A: None associated

10.0 Content Competencies – Level I

10.1 Module 10 – Career Management and Employee Relations: Designed to introduce career opportunities and functions of the metalworking industries. The Learner will develop a career plan and an understanding of organizational structures and employment relationships. Interviewing skills and team skills will be practiced.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
10.1.1 Career Planning - Develop and explain a short-term career plan and résumé.	EWA2.5 p52; EW1.5 p59; EW2.3f p60; EW2.6a p61; ESA2.2f p64; EW1.6 p69; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74; ESA2.3c p74	N/A	N/A	SSE12.4.2 p60; SSE12.4.3 - p60
10.1.2 Job Application and Interviewing – Complete job application form and demonstrate interviewing skills.	ESA2, 3 o48; EWA2.5 p52; EW2.3d p60; EW2.3f p60; EW2.6a & b p61; EL1.7 p63; ESA2.2d p64; ER2.3 p66; EWO1.2 p72; ELSS1.8c p73; ESA2.3c p74	N/A	N/A	SSE12.4.2 p60

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10.1.3 Teamwork and Interpersonal Relations – Demonstrate appropriate interpersonal skills in job performance evaluations, group communication and decision making, and conflict resolution.	EW1.3 p44; ESA2.3 p48; EWA2.6a p52; EW1.5 p59; EW2.3f p60; EW2.6a p61; ESA2.2f p64; EWA2.3c p70; EWO1.2 p72; ESA2.1c p74; ESA2.3c p74	N/A	N/A	N/A
10.1.4 Employment Relations – Understand and explain employment rights and responsibilities in metalworking companies.	ESA2.3 p48; EWA2.6a p52; EW1.5 p59; EW2.3f p60; EW2.6a & b p61; ESA2.2f p64; ER2.3 p66; EW1.5 p69; EW1.6 p 69; EWA2.1e p70; EWA2.3c p70; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74; ESA2.3c p74	N/A	N/A	SSH10.3.4 p43

Note: **Boldface type** indicates those standards proposed for assessment on the *California High School Exit Examination*.

N/A: Not associated

11.0 Content Competencies – Level I

11.1 Module 11 – Industry Experience: Expand knowledge and experiences working in a machining/manufacturing environment by using cooperative education and/or community classroom methodologies.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
11.1.1 Industrial Experience – Explore and understand the machining/manufacturing environment.	EWA2.6a p52; EW1.5 p59; EW2.3f p60; EW2.6a p61; ESA2.2f p64; EWA2.1e p70; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74	N/A	N/A	SSH10.3.5 p43
11.1.2 Related Classroom Experience – Discuss and develop an annotated list of high-quality personal, technical, and job-related skills necessary to be an employable person in the specific occupation.	EWA2.5 p52; EW1.5 p59; EW2.3f p60; EW2.6a p61; ESA2.2f p64; EWO1.2 p72; ELSS1.8c p73	N/A	N/A	SSH11.8.7 p51; SSE12.2.3 p59

Note: **Boldface type** indicates those standards proposed for assessment on the *California High School Exit Examination*.

N/A: None associated

1.0 Content Competencies – Level II

1.1 Module 1 – Job Planning and Management: Designed to allow hands-on skill advancement. Emphasis will be on part process planning and capability studies. Development of a working knowledge in part routing and process planning sheets is required. Participation as a team member in capability studies using and interpreting statistical data is required.

Links to Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
1.1.1 Job Process Planning: Write a detailed process plan that includes a quality plan for a part requiring milling, drilling, turning, or grinding. Produce an operation sheet detailing the process plan and required speeds, feeds, depths of cuts, and coolant needs. Provide sketches as needed.	EWA2.6a p52; ER2.6 p57 ; EW2.3d p60; EW2.3f p60 ; EW2.6a & b p61 ; EL1.7 p63; ESA2.2d & f p64; EW1.6 p69; EWO1.2 p72; ELSS1.8c p73	MNS1.2 p29 ; MMG1.2 p32 ; MMG3.1 p32 ; MMG3.5 p33 ; MMR2.1 p34 ; MMR2.8 p34 ; MMR3.3 p34 ; MA3.0 p38 ; MA5.0 p38 ; MA13.0 p39	SPS1c p26; SPS1f p26; SC1b p36	N/A
1.1.2 Participate in Capability Studies – Participate as a team member in a capability study. Perform the required statistical calculations to support the capability study. With the assistance of the team leader prepare the necessary shop reports for the capability study.	EW1.3 p44; EWA2.6a p52; EW1, 5 o59 ; EW2.3f p60 ; EW2.6a p61 ; ESA2.2d p64; ESA2.2f p64; EW1.6 p69; EWA2.4a p70; EWO1.2 p72; ELSS1.8c p73	MNS1.2 p29 ; MNS1.3 p29 ; MAF1.1 p30 ; MAF3.2 p31 ; MMG1.2 p32 ; MMG2.1 p32 ; MMR2.1 p34 ; MA5.0 p38 ; MG9.0 p42; MG11.0 p42	N/A	SSH11.2.5 p48; SSH11.5.7 p50

Note: Boldface type indicates those standards proposed for assessment on the *California High School Exit Examination*.

N/A: Not associated

2.0 Content Competencies – Level II

2.1 Module 2 – Manual Operations: Designed to provide hands-on skill advancement in layout practices and operations. Emphasis will be on bolt hole circles, location of surfaces related by nonright angles, and points of tangency. The student is required to perform practices necessary to lay out a part given the raw material, process plan, drawing, tooling, and measuring instruments.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
2.1.1 Layout Bolt Circles, Angles, Tangency Points, Line Profiles – Set up and lay out bolt circles, locations of surfaces related by nonright angles, locations of points of tangency between arcs and lines, and profiles of a line that is nonarc based.	ESA2.3 p48; ER2.6 p57 ; EW2.3f p60 ; ELSS1.8c p73	MNS1.2 p29 ; MMG1.1 p32 ; MMG1.2 p32 ; MMG3.1 p32 ; MMR2.1 p34 ; MMR2.8 p34 ; MA5.0 p38 ; MG19.0 p43; MT1.0 p47; MT2.0 p47; MT15.0 p48; MT16.0 p48; MT19.0 p48; MMA1.0 p49	N/A	N/A

Note: Boldface type indicates those standards proposed for assessment on the *California High School Exit Examination*.

N/A: Not associated

3.0 Content Competencies – Level II

3.1 Module 3 – Band Saw Operation: Designed to provide hands-on skill advancement in operations of standard band saws. Emphasis of this module will be on contour band sawing and blade welding. The student is required to perform practices necessary to produce a part given the raw material, process plan, drawing, tooling, and measuring instruments.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
3.1.1 Contour Band Sawing – Set up and perform contour sawing according to the layout. Choose and mount appropriate blades. Weld, break, and reweld blades as necessary.	ESA2.3 p 48; EWA2.6a p52; ER2.6 p57 ; EW2.3f p60 ; EW2.6a & b p61 ; ESA2.2f p64; EWO1.2 p 72; ELSS1.8c p73; ESA2.1a p74	MNS1.2 p29 ; MMG1.2 p32 ; MMg2.4 p32 ; MA5.0 p38	SPS1c p26; SPS1f p26; SPS2d p27	N/A

Note: **Boldface type** indicates those standards proposed for assessment on the *California High School Exit Examination*.

N/A: Not associated

4.0 Content Competencies – Level II

4.1 Module 4 – Turning Operations: Designed to provide hands-on skill advancement in lathe operations. Produce outside and inside diameter tapers, using a taper turning attachment, production turning, and turning between centers.

Link to Content Standards for California Public Schools

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
4.1.1 Turning Operations, Between Centers Taper Turning – Setup and perform operations between centers turning for straight and tapered turning by offsetting the tailstock.	ESA2, 3 p48; ER2.5 p50; ER2.6 p57; EW2.3f p60; EW2.6 a & b p61; ESA2.2f p64; EWO1.2 p72; ELSS1.8c p73	MNS1.2 p29; MNS1.3 p29; MAF1.5 p30; MMG1.1 p32; MMG1.2 p32; MMG3.1 p33; MMG3.5 p33; MA5.0 p38;	SPS1c p26; SPS1f p26; SPS2d p27; SPT7c p29; SP1d p31; SIE1c p52	SSGH8.12.9 p39; SSH10.3.2 p43; SSH11.5.7 p50

Note: **Boldface type** indicates those standards proposed for assessment on the *California High School Exit Examination*.

N/A: None associated

5.0 Content Competencies – Level II

5.1 Module 5 – Milling Machine Operations: Designed to provide hands-on skill advancement in the operations of standard horizontal milling machines. The student will produce a part when given the raw material, process plan, drawing, tooling, and necessary measuring instruments.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
5.1.1 Horizontal Milling, Square Up a Block – Set up and perform squaring six surfaces of a block to within a +/- .002" and .002" over 4" tolerance.	ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57; EW2.3f p60; EW2.6a & b p61; EL1.7 p63; ESA2.2f p64; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74	MNS1.2 p29; MNS1.3 p29; MMG1.2 p32; MMG3.1 p32; MMR2.1 p34; MMR2.8 p34; MA5.0 p38	SPS2d p27; SPS3f p27; SPT7c p29; SIE1c p 52	SSHG8.10.2 p37; SSGH8.12.9 p39; SSH10.3.2 p43; SSH11.5.7 p50
5.1.2 Horizontal Mill, Cut a Key Seat – Set up and perform milling key seats on a shaft.	ESA2.3 p48; ER2.5 p50; EWA2.6a p52 ER2.6 p57; EW2.3f p60; EW2.6a & b p61; EL1.7 p63; ESA2.2f p64; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74	MNS1.2 p29; MNS1.3 p29; MAF1.5 p30; MMG1.2 p32; MMG3.1 p32; MMR2.1 p34; MMR2.8 p34; MA5.0 p38	SPS1c p26; SPS1f p26; SC1b p36; SIE1c p52	SSHG8.10.2 p37; SSGH8.12.9 p39; SSH10.3.2 p43; SSH11.5.7 p50
5.1.3 Horizontal Mill, Cut a Deep Slot with a Stagger Tooth Cutter – Set up and perform the cutting of a deep slot using a stagger tooth cutter.	ESA2.3 p48; ER2.5 p 50; EWA2.6a p52 ER2.6 p57; EW2.3f p60; EW2.6a & b p61; EL1.7 p63; ESA2.2f p64; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74	MNS1.2 p29; MNS1.3 p29; MAF1.5 p30; MMG1.2 p32; MMG3.1 p32; MMR2.1 p34; MMR2.8 p34; MA5.0 p38	SPS2d p27; SPS3f p27; SPT7c p29; SIE1c p52	SSHG8.10.2 p37; SSGH8.12.9 p39; SSH10.3.2 p43; SSH11.5.7 p50

Note: **Boldface type** indicates those standards proposed for assessment on the *California High School Exit Examination*.

N/A: None associated

6.0 Content Competencies – Level II

6.1 Module 6 – Milling Attachment Operations: Designed to provide skill advancement in the operations of standard vertical milling machines. Common milling attachments and their uses will be introduced. Use of rotary tables and dividing and boring heads will be understood in detail. The student will perform tasks necessary to produce a part given the raw material, process plan, drawing, tooling, and measuring instruments.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
6.1.1 Vertical Milling, Precision Location of Holes – Set up and perform boring for location, size and finish.	ESA2.3 p48; ER2.5 p 50; EWA2.6a p52 ER2.6 p57; EW2.3f p60; EW2.6a & b p61; EL1.7 p63; ESA2.2f p64; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74	MNS1.2 p29; MNS1.3 p29; MAF1.5 p30; MMG1.1 p32; MMG1.2 p32; MMG2.1 p32; MG3.1 p32; MMG3.5 p33; MMR2.1 p34; MMR2.8 p34; MA5.0 p38; MG9.0 p42	SIE1c p52	SSHG8.10.2 p37; SSGH8.12.9 p39; SSH10.3.2 p43; SSH10.3.3 p43; SSH10.3.4 p43 SSH10.3.5 p43; SSH11.5.7 p50
6.1.2 Vertical Mill, Use Rotary Tables – Set up and perform the development of surfaces at a specified non-right angle using a rotary table. Set up and establish hole locations in various relationships to one another using a rotary table. The holes are in the same plane. Establish the profile of a radius with respect to two surfaces and the connecting points of	ESA2.3 p48; ER2.5 p 50; EWA2.6a p52 ER2.6 p57; EW2.3f p60; EW2.6a & b p61; EL1.7 p63; ESA2.2f p64; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74	MNS1.2 p29; MAF1.5 p30; MMG1.2 p32; MG2.2 p32; MMG3.1 p32; MMG3.3 p33; MMG1.1 p34; MMG1.3 p34; MMR2.1 p34; MMR2.8 p34; MMR3.3 p34; MA5.0 p38; MA6.0 p38; MG15.0 p43; MG20.0 p43; MT2.0 p47; MT16.0 p48	SPT7c p29; SIE1c p52	SSHG8.10.2 p37; SSGH8.12.9 p39; SSH10.3.2 p43; SSH11.5.7 p50

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tangency.				
<p>6.1.3 Vertical Mill, Dividing Head Operations</p> <p>– Set up and perform operations requiring a dividing head. Set up and establish hole locations in various relationships to one another using a dividing head. Establish the profile of a radius with respect to two surfaces and connecting points of tangency.</p>	<p>ESA2.3 p48; ER2.5 p 50; EWA2.6a p52 ER2.6 p57; EW2.3f p60; EW2.6a & b p61; EL1.7 p63; ESA2.2f p64; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74</p>	<p>MNS1.2 p29; MAF1.5 p30; MMG1.1 p32; MMG1.2 p32; MMG2.1 p32; MMG3.1 p32; MMG3.5 p33; MMR2.1 p34; MMR2.8 p34; MMR3.3 p34; MA5.0 p38; MG19.0 p43; MT1.0 p47; MT2.0 p47; MT16.0 p48</p>	<p>SPT7c p29; SIE1c p52</p>	<p>SSHG8.10.2 p37; SSGH8.12.9 p39; SSH10.3.2 p43; SSH11.5.7 p50</p>

Note: **Boldface type** indicates those standards proposed for assessment on the *California High School Exit Examination*.

N/A: None associated

7.0 Content Competencies – Level II

7.1 Module 7 – Horizontal Milling Machine Operations: Designed for skill advancement in the operations of standard horizontal boring mill machines. Tooling, adjustable boring heads, and precision boring operations will be emphasized. The student is required to perform all work necessary to produce a part given the raw material, process plan, drawing, tooling, and measuring instruments.

Links to Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
7.1.1 Basic Horizontal Boring Milling Operations Set up and perform boring for location, size, and finish and mill a slot for location and size.	ESA2.3 p48; ER2.5 p 50; EWA2.6a p52 ER2.6 p57; EW2.3f p60; EW2.6a & b p61; EL1.7 p63; ESA2.2f p64; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74	MNS1.2 p29; MNS1.3 p29; MAF1.1 p30; MMG1.1 p32; MMG1.2 p32; MMG2.4 p32; MMG3.1 p32; MMG3.2 p33; MMR2.1 p34; MA5.0 p38	SPS3f p27; SIE1b p52; SIE1c p52	SSHG8.10.2 p37; SSGH8.12.9 p39; SSH10.3.2 p43; SSH10.3.3 p43; SSH10.3.4 p43 SSH10.3.5 p43; SSH11.5.7 p50

Note: **Boldface type** indicates those standards proposed for assessment on the *California High School Exit Examination*.

N/A: None associated

8.0 Content Competencies – Level II

8.1 Module 8 – Grinding Operations: Designed to provide skill advancement in the operations of standard surface and cylindrical grinding machines. This module will emphasize grinding wheel selection and preparation and precision grinding practices for flats, angles, and straight diameters. The student is required to perform all work necessary to produce a part given the raw material, process plan, drawing, tooling, and measuring instruments.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
8.1.1 Surface Grinding, Finish Flats to +/- .0005" – Grind a block's six faces to finished dimensions having tolerances of +/- .0005" and square ness of .0005" over 4" and 32 microinch surface finish. Dress the wheel as necessary.	EW1.3 p44; ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57; EW2.3f p60; EW2.6a & b p61; EL1.7 p63; ESA2.2f p64; EWA2.1e p70; EWO1.2 p72; ELSS1.8c p73	MNS1.2 p29; MNS1.3 p29; MMG1.2 p32; MMG3.3 p33; MMR2.1 p34; MA5.0 p38	SPS1c p26; SPS3f p27; SPT7c p29; SIE1L p52	SSH11.5.7 p50; SSE12.4.2 p60
8.1.2 Surface Grinding, Finish Flats at Simple Angles – Set up and perform the finish surface grinding of flat surfaces at simple angles to one another. Dress the wheel as necessary.	EW1.3 p44; ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57; EW2.3f p60; EW2.6a & b p61; EL1.7 p63; ESA2.2f p64; EWA2.1e p70; EWO1.2 p72; ELSS1.8c p73	MNS1.2 p29; MNS1.3 p29; MMG1.2 p32; MMG3.3 p33; MMR2.1 p34; MA5.0 p38	SPS1c p26; SPS3f p27; SPT7c p29; SIE1L p52	SSH11.5.7 p50; SSE12.4.2 p60
8.1.3 Grinding Wheel Preparation and Balancing – Set up and perform the balancing operation of a 14" greater diameter grinding wheel. Place the wheel into service.	EW1.3 p44; ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57; EW2.3f p60; EW2.6a & b p61; EL1.7 p63; ESA2.2f p64; EWA2.1e p70; EWO1.2 p72; ELSS1.8c p73	N/A	SPS2b p26; SPS2d p27; SIE1b p52; SIE1c p52	N/A

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8.1.4 Cylindrical Grinding – Set up and perform between centers grinding for straight diameters. Dress the wheel as necessary.	EW1.3 p44; ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57; EW2.3f p60; EW2.6a & b p61; EL1.7 p63; ESA2.2f p64; EWA2.1e p70; EWO1.2 p72; ELSS1.8c p73	MNS1.2 p29; MNS1.3 p29; MMG1.2 p32; MA5.0 p38	SPS2b p26; SPS2d p27; SIE1b p52; SIE1c p52	SSH11.5.7 p50; SSE12.4.2 p60
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Note: **Boldface type** indicates those standards proposed for assessment on the *California High School Exit Examination*.

N/A: None associated

9.0 Content Competencies – Level II

9.1 Module 9 – Radial Drill Operation: Designed to provide hands-on skill advancement in the operations of standard radial drills. Drilling, reaming, and power tapping will be emphasized. The students is required to perform all practices necessary to produce a part given raw material, process plan, drawing, tooling, and measuring instruments.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
9.1.1 Drilling, Radial Drill – Set up and perform drilling operations using a radial drill.	ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57 ; EW2.3f p60 ; EW2.6a & b p61 ; EL1.7 p63; ESA2.2f p64; EWA2.1e p70; ELSS1.8c p73	MNS1.2 p29 ; MNS1.3 p29 ; MAF1.5 p30 ; MMG1.2 p32 ; MMG3.1 p32 ; MA5.0 p38	SIE1c p52	SSHG8.10.2 p37; SSGH8.12.9 p39; SSH10.3.2 p43; SSH11.5.7 p50

Note: **Boldface type** indicates those standards proposed for assessment on the *California High School Exit Examination*.

N/A: None associated

10.0 Content Competencies – Level II

10.1 Module 10 – Electro Discharge Machine (EDM): Designed to introduce hands-on skill advancement in the operations of standard electromechanical discharge plunge and two axis wire EDM machines. The setup and operation of EDM machines will be emphasized. The students is required to perform all practices necessary to produce a part given the raw material, process plan, drawing, tooling, and measuring instruments are required.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
10.1.1 EDM, Operate a Plunge EDM – Operate a plunge electric discharge machine.	EW1.3 p44; ER2.5 p50; EWA2.6a p52; ER2.6 p57 ; EW2.3f p60 ; EW2.6a & b p61 ; EL1.7 p63; ESA2.2f p64; EWA2.1e p70; EWO1.2 p72; ELSS1.8c p73; ESA2.3c p74	MNS1.2 p29 ; MNS1.3 p29 ; MMG1.2 p32 ; MMG3.1 p32 ; MMR2.1 p34 ; MMR2.8 p34 ; MMR3.3 p34	SPS2d p27; SPS3a p27; SPSS3f p27; SPT7c p29; SP1d p31; SC1b p36; SIE1c p52; SIE1L p52	SSH10.3.2 p43; SSH11.8.7 p51
10.1.2 EDM, Operate a two Axis Wire EDM – Operate a two-axis wire electric discharge machine.	EW1.3 p44; ER2.5 p50; EWA2.6a p52; ER2.6 p57 ; EW2.3f p60 ; EW2.6a & b p61 ; EL1.7 p63; ESA2.2f p64; EWA2.1e p70; EWO1.2 p72; ELSS1.8c p73; ESA2.3c p74	MNS1.2 p29 ; MNS1.3 p29 ; MMG1.2 p32 ; MMG3.1 p32 ; MMR2.1 p34 ; MMR2.8 p34 ; MMR3.3 p34 ; MA6.0 p38 ; MT15.0 p48	SPS2d p27; SPS3a p27; SPSS3f p27; SPT7c p29; SP1d p31; SC1b p36; SIE1c p52; SIE1L p52	SSH10.3.2 p43; SSH11.8.7 p51

Note: **Boldface type** indicates those standards proposed for assessment on the *California High School Exit Examination*.

N/A: None associated

11.0 Content Competencies – Level II

11.1 Module 11 – Computer Numerical Control Mill (CNC) Designed to introduce hands-on skill advancement in the operations of standard CNC milling machines. CNC mill programming and mill operation will be introduced. The student is required to perform all practices necessary to produce a part given the raw material, process plan, drawing, tooling, and measuring instruments.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
11.1.1 CNC, Write Simple RS274-D Programs – Using computer and editor software, write simple RS274-D programs. Simple programs are single plane, cutter centerline, linear and circular interpolation, and single cutter, with no canned cycles.	ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57; EW2.3f p60; EW2.6a & b p61; EL1.7 p63; ESA2.2f p64; EWA2.1e p70; EWO1.2 p72; ELSS1.8c p73; ESA2.4a p75	MNS1.2 p29; MNS1.3 p29; MAF1.1 p30; MMG1.2 p32 MMG3.1 p32; MMG3.2 p33; MMG3.5p 33; MMG1.1 p34; MMR2.1 p34; MMR2.8 p34; MA3.0 p38; MA5.0 p38; MA6.0 p38; MG15.0 p43; MG18.0 p43; MG19.0 p43; MG20.0 p43; MT2.0 p47; MT15.0 p48; MT16.0 p 48; MT19.0 p48; MMA1.0 p49	SPS1c p26; SPS1f p26; SPPS2d p27; SPS3f p27	SSHG8.12.4 p38; SSGH8.12.9 p39; SSH10.3.2 p43; SSH11.2.2 p48; SSH11.5.7 p50; SSH11.7.6 p51; SSH11.8.7 p51; SSE12.3.1 p60; SSE12.4.2 p60
11.1.2 CNC, Operate a CNC Milling Machine – Operate a CNC milling machine.	ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57; EW2.3d p60; EW2.3f p60; EW2.6a & b p61; EL1.7 p63; ESA2.2d & f p64; EWO1.2 p72; ELSS1.8c p73; ESA2.4a p75	MNS1.2 p29; MNS1.3 p29; MMG1.2 p32; MMR2.1 p34; MA6.0 p38	SIE1c p52	SSHG8.12.4 p38; SSGH8.12.9 p39; SSH10.3.2 p43; SSH11.2.2 p48; SSH11.5.7 p50; SSH11.7.6 p51; SSH11.8.7 p51; SSE12.3.1 p60; SSE12.4.2 p60

Note: **Boldface type** indicates those standards proposed for assessment on the *California High School Exit Examination*.

N/A: None associated

12.0 Content Competencies – Level II

12.1 Module 12 – CNC Turning Center Operations: Designed to introduce hands-on advancement in the operations of standard CNC turning center. CNC turning center programming and operation will be introduced. The student is required to perform all practices necessary to produce a part given the raw material, process plan, drawing, tooling, and measuring instruments.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
12.1.1 CNC, Write Simple RS272-D Programs – Using computer and editor software, write simple RS274-D programs. Simple programs are single plane, cutter centerline, linear and circular interpolation, and single cutter, with no canned cycles.	ESA2, 3 p48; EWA2.6a p52; ER2.6 p 57; EW2.3f p60; EW2.6a & b p61; ESA 2.2d & f p64; EWO1.2 p72; ELSS1.8c p73; ESA2.4a p75	MNS1.2 p29; MNS1.3 p29; MMG1.2 p32; MMG3.2 p33; MMG3.5 p33; MMG1.1 p34; MMR2.1 p34; MMR2.8 p34; MA5.0 p38; MA6.0 p38; MT2.0 pg47; MT15.0 p48; MT16.0 p48 MMA1.0 p49	SPS1c p26; SPS1f p26; SPS2d p27; SPS3f p27	SSHG8.12.4 p38; SSGH8.12.9 p39; SSH10.3.2 p43; SSH11.2.2 p48; SSH11.5.7 p50; SSH11.7.6 p51; SSH11.8.7 p51; SSE12.3.1 p60; SSE12.4.2 p60
12.1.2 CNC, Operate a CNC Turning Center – Operate a CNC turning center.	ESA2.3 p48; ER2.5 p50; EWA2.6a p52; ER2.6 p57; EW2.3d p60; EW2.3f p60; EW2.6a & b p61; EL1.7 p63; ESA2.2d & f p64; EWO1.2 p72; ELSS1.8c p73; ESA2.4a p75	MNS1.2 p29; MNS1.3 p29; MMG1.2 p32	SIE1c p52	SSHG8.12.4 p38; SSGH8.12.9 p39; SSH10.3.2 p43; SSH11.2.2 p48; SSH11.5.7 p50; SSH11.7.6 p51; SSH11.8.7 p51; SSE12.3.1 p60; SSE12.4.2 p60

Note: **Boldface type** indicates those standards proposed for assessment on the *California High School Exit Examination*.

N/A: None associated

13.0 Content Competencies – Level I

13.1 Module 13 – Industry Experience: Expand skill levels working in a machining/manufacturing environment by using cooperative education and/or community classroom methodologies.

Links to Academic Content Standards

Benchmarks	English Standards	Math Standards	Science Standards	Social Science/ History Standards
13.1.1 Industry Experience – Work in a machining/manufacturing environment.	EW1.3 p44; ESAA2.3 p48; ER2.2 p49; ER2.5 p50; EWA2.5 p52; EWA2.6a p52; ER2.6 p57; EW1.5 p59; EW2.3f p60; EW2.6a & b p61; ESA2.2f p64; EW1.5 p69; EWO1.2 p72; ELSS1.8c p73; ESA2.1a p74; ESA2.3c p74; ESA2.4a p75	MNS1.2 p29; MNS1.3 p29; MAF1.1 p30; MAF3.2 p31; MMG1.1 p32; MMG1.2 p32; MMG2.2 p32; MMG2.4 p32; MMG3.1 p32; MMG3.2 p33; MMG3.3 p33; MMG3.4 p33; MMG1.1 p34; MMR2.1 p34; MMR2.8 p34; MMR3.3 p34; MA5.0 p38; MA6.0 p38; MA24.1 p40; MG10.0 p42; MG15.0 p43; MG18.0 p43; MG19.0 p43; MG20.0 p43; MT1.0 p47; MT2.0 p47; MT15.0 p48; MT19.0 p48; MMA1.0 p49	SPS1c p26; SPS1f p26; SPS2d p27; SPS3f p27; SPTc p29; SP1d p31; SP1g p31; SC1b p36; SIE1b p 52; SIE1c p52; SIE1L p52	SSH10.3.2 p43; SSH10.3.4 p43; SSH11.5.7 p50; SSH11.8.7 p51; SSE12.2.2 p59; SSE12.4.2 p60; SSE12.4.3 p60

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13.1.2 Related Classroom Experience – Receive in-depth instruction regarding proper use, procedures of advanced equipment and to produce parts and advance personal and technical skills necessary to be a quality employee in the manufacturing trades.	EW1.3 p44; ESA2.3 p48; ER2.5 p50; EWA2.6a p52; EW2.3f p60; EW2.6a & b p61; ESA2.2f p64; ER2.3 p66; EWA2.3c p70; EWO1.2 p72; ELSS1.8c p73; ESA2.3c p74; ESA2.4a p75	MAF1.1 p30; MAF3.2 p31; MMG1.1 p32; MMG1.2 p32; MMG2.2 p32; MMG2.4 p32; MMG3.1 p32; MMG3.2 p33 MMG3.3 p33; MMG3.4 p33; MMG1.1 p34; MMR2.1 p34; MMR2.8 p34; MMR3.3 p34; MA5.0 p38; MA6.0 p38; MA24.1 p40; MG10.0 p42; MG15.0 p43; MG18.0 p43; MG19.0 p43; MG20.0 p43; MT1.0 p47; MT2.0 p47; MT15.0 p48; MT19.0 p48; MMA1.0 p49	SPS1c p26; SPS1f p26; SPS2d p27; SPS3f p27; SPTc p29; SP1d p31; SP1g p31; SC1b p36; SIE1b p 52; SIE1c p52; SIE1L p52	SSH10.3.2 p43; SSH10.3.4 p43; SSH11.5.7 p50; SSH11.8.7 p51; SSE12.2.2 p59; SSE12.4.2 p60; SSE12.4.3 p60
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Note: **Boldface type** indicates those standards proposed for assessment on the *California High School Exit Examination*.

N/A: None associated

English-Language Arts Content Standards

Grades 7 and 8

ER2.5 – Pg. 43: Reading App. Understand and explain the use of a simple mechanical device by following technical directions.

EW1.3 – Pg. 44: Writing App. Use strategies of notetaking, outlining, and summarizing to impose structure on composition drafts.

ESA2.3b – Pg. 48: Speaking App. Convey clear and accurate perspectives on the subject.

ER2.1 – Pg. 49: Reading App. Compare and contrast the features and elements of consumer materials to gain meaning from documents (e.g., warranties, contracts, product information, instruction manuals).

ER2.5 – Pg. 50: Reading App. Understand and explain the use of a complex mechanical device by following technical directions.

EWA2.5 – Pg. 52: Writing App. Write documents related to career development, including simple business letters and job applications.

EWA2.6a – Pg. 52: Writing App. Identify the sequence of activities needed to design a system, operate a tool, or explain the bylaws of an organization.

EW01.6 – Pg. 53: Written and Oral App. Use correct spelling conventions.

Grades 9 and 10

ER2.6 – Pg. 57: Reading App. Demonstrate use of sophisticated learning tools by following technical directions.

EW1.5 – Pg. 59: Writing App. Synthesize information from multiple sources and identify complexities and discrepancies in the information and the different perspectives found in each medium (e.g., almanacs, microfiche, news sources, in-depth field studies, speeches, journals, and technical documents).

EW2.3d – Pg. 60: Writing App. Include visual aids by employing appropriate technology to organize and record information on charts, maps, and graphs.

EW2.3f – Pg. 60: Writing App. Use technical terms and notations accurately.

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EW2.6a – Pg. 61: Writing App. Report information and convey ideas logically and correctly.

EW2.6b – Pg. 61: Writing App. Offer detailed and accurate specifications.

EL1.7 – Pg. 63: Listening and Speaking - Use props, visual aids, graphs, and electronic media to enhance the appeal and accuracy of presentations.

ESA2.2d – Pg. 64: Speaking App. Include visual aids by employing appropriate technology to organize and display information on charts, maps, and graphs.

ESA2.2f – Pg. 64: Speaking App. Use technical terms and notations accurately.

Grades 11 and 12

ER2.3 – Pg. 66: Verify and clarify facts presented in other types of expository texts by using a variety of consumer, workplace, and public documents.

EW1.5 – Pg. 69: Use language in natural, fresh, and vivid ways to establish a specific tone.

EW1.6 – Pg. 69: Develop presentations by using clear research questions and creative and critical research strategies (e.g., field studies, oral histories, interviews, experiments, electronic sources).

EWA2.1c – Pg. 70: Describe with concrete sensory details the sights, sounds, and smells of a scene and the specific actions, movements, gestures, and feelings of the characters; use interior monologue to depict the characters' feelings.

EWA2.1e – Pg. 70: Make effective use of descriptions of appearance, images, shifting perspectives, and sensory details.

EWA2.3c – Pg. 70: Maintain a balance in describing individual incidents and relate those incidents to more general and abstract ideas.

EWA2.4a – Pg. 70: Use exposition, narration, description, argumentation, exposition, or some combination of rhetorical strategies to support the main proposition.

EW01.2 – Pg. 72: Produce legible work that shows accurate spelling and correct punctuation and capitalization.

ELSS1.8c – Pg. 73: Oral communication - Technical language for specificity.

ESA2.1a – Pg. 74: Explore the significance of personal experiences, events, conditions, or concerns, using appropriate rhetorical strategies (e.g., narration, description, exposition, persuasion).

ESA2.3c – Pg. 74: Support important ideas and viewpoints through accurate and detailed references to the text or to other works.

ESA2.4a – Pg. 75: Combine text, images, and sound by incorporating information from a wide range of media, including films, newspapers, magazines, CD-ROMs, online information, television, videos, and electronic media-generated images.

Mathematics Content Standards

MNS1.2 – Pg. 29: Add, subtract, multiply, and divide rational numbers (integers, fractions, and terminating decimals) and take positive rational numbers to whole-number powers.

MNS1.3 – Pg. 29: Convert fractions to decimals and percents and use these representations in estimations, computations and applications.

MAF1.1 – Pg. 30: Use variables and appropriate operations to write an expression, an equation, an inequality, or a system of equations or inequalities that represents a verbal description (e.g., three less than a number, half as large as area A). **Application:** Figuring volume and weight – casting of materials for machining. How much will it weigh when finished?

MAF1.5 – Pg. 30: Represent quantitative relationships graphically and interpret the meaning of a specific part of a graph in the situation represented by the graph. **Application:** Example of a stress-strain curve on various materials.

MAF2.1 – Pg. 31: Interpret positive whole-number powers as repeated multiplication and negative whole-number powers as repeated division or multiplication by the multiplicative inverse. Simplify and evaluate expressions that include exponents. **Application:** Volume measurement would use this square/cube half volume, tenth volume.

MAF3.2 – Pg. 31: Plot the values from the volumes of three-dimensional shapes for various values of the edge lengths (e.g., cubes with varying edge lengths or a triangle prism with a fixed height and an equilateral triangle base of varying lengths). **Application:** Figuring the amount of material to be cast for machining. Weights of finished part, multiplied by specific gravity.

MAF3.4 – Pg. 31: Plot the values of quantities whose ratios are always the same (e.g., cost to the number of an item, feet to inches, circumference to diameter of a circle). Fit a line to the plot and understand that the slope of the line equals the quantities. **Application:** Specific gravity – if quantity is doubled, weight and volume are also doubled. Specific gravity would be the constant in the ratio.

MMG1.1 – Pg. 32: Compare weights, capacities, geometric measures, times, and temperatures within and between measurement systems (e.g., miles per hour and feet per second, cubic inches to cubic centimeters). **Application:** Conversion between systems of measurement.

MMG1.2 – Pg. 32: Construct and read drawings and models made to scale.

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- MMG2.1 – Pg. 32: Use formulas routinely for finding the perimeter and area of basic two-dimensional figures and the surface area and volume of basic three-dimensional figures, including rectangles, parallelograms, trapezoids, squares, triangles, circles, prisms and cylinders.
- MMG2.2 – Pg. 32: Estimate and compute the area of more complex or irregular two- and three-dimensional figures by breaking the figures down into more basic geometric objects. **Application:** Break down a complex figure into more basic geometric objects.
- MMG2.4 – Pg. 32: Relate the changes in measurement with a change of scale to the units used (e.g., square inches, cubic feet) and to conversions between units (1 square foot = 144 square inches, and 1 cubic inch is approximately 16.38 cubic centimeters). **Application:** Conversion of imperial to metric.
- MMG3.1 – Pg. 32: Identify and construct basic elements of geometric figures (e.g., altitudes, midpoints, diagonals, angle bisectors, and perpendicular bisectors; central angles, radii, diameters, and chords of circles) by using a compass and straightedge. **Application:** Layout of part prior to machining. Drawing of layout on part.
- MMG3.2 – Pg. 33: Understand and use coordinate graphs to plot simple figures, determine lengths and areas related to them, and determine their image under translations and reflections. **Application:** Polar coordinates are coordinate graphs. Xy is linear graphing.
- MMG3.3 – Pg. 33: Know and understand the Pythagorean theorem and its converse and use it to find the length of the missing side of a right triangle and the lengths of other line segments and, in some situations, empirically verify the Pythagorean theorem by direct measurement. **Application:** $a^2 + b^2 = c^2$. The theorem may also used to verify right angles.
- MMG3.5 – Pg. 33: Construct two-dimensional patterns for three-dimensional models, such as cylinders, prisms, and cones. **Application:** Producing drawings (two-dimensional drawings that make it 1=1) a pattern and then cutting three-dimensional model.
- MMG1.1 – Pg. 34: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns. **Application:** Logical reasoning – sequencing of operations and identifying missing information. Breaking a problem into sequence of components.
- MMG1.3 – Pg. 34: Determine when and how to break a problem into simpler parts.
- MMR2.1 – Pg. 34: Use estimation to verify the reasonableness of calculated results. **Application:** Use of basic logic to check against calculated answer. Use of approximations to verify accuracy.
- MMR2.2 – Pg. 34: Apply strategies and results from simpler problems to more complex problems. **Application:** Going from the simple to more complex from cube to extended cube shape.

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- MMR2.8 – Pg. 34: Make precise calculations and check the validity of the results from the context of the problem. **Application:** Doing mathematical calculation before machining the part.
- MMR3.3 – Pg. 34: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations. **Application:** Use one problem to spring to the next level of difficulty.
- MA1.0 – Pg. 38: Students identify and use the arithmetic properties of subsets of integers and rational, irrational, and real numbers, including closure properties for the four basic arithmetic operations where applicable.
- MA3.0 – Pg. 38: Students solve equations and inequalities involving absolute values. **Application:** All measurements will be nonnegative numbers.
- MA5.0 – Pg. 38: Students solve multistep problems, including word problems, involving linear equations and linear inequalities in one variable and provide justification for each step. **Application:** Used to calculate speeds and feeds.
- MA6.0 – Pg. 38: Students graph a linear equation and compute the x - and y - intercepts (e.g., graph $2x + 6y = 4$). They are also able to sketch the region defined by linear inequality (e.g., they sketch the region defined by $2x + 6y < 4$). **Application:** Graphing of rectangular (xy) coordinates.
- MA13.0 – Pg. 39: Students add, subtract, multiply, and divide rational expressions and functions. Students solve both computationally and conceptually challenging problems by using these techniques. **Application:** Rational expression can be any number.
- MA24.1 – Pg. 40: Students explain the difference between inductive and deductive reasoning and identify and provide examples of each. **Application:** Explain difference between inductive and deductive reasoning or logic.
- MG9.0 – Pg. 42: Students compute the volumes and surface areas of prisms, pyramids, cylinders, cones, and spheres. Students commit to memory the formulas for prisms, pyramids, and cylinders.
- MG10.0 – Pg. 42: Students compute areas of polygons, including rectangles, scalene triangles, equilateral triangles, rhombi, parallelograms, and trapezoids. **Application:** Calculation of the base or face of a solid.
- MG11.0 – Pg. 42: Students determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures and solids.
- MG15.0 – Pg. 43: Students use the Pythagorean theorem to determine distance and find missing lengths of sides of right triangles. **Application:** Measuring and checking of squareness.
- MG18.0 – Pg. 43: Students know the definitions of the basic trigonometric functions defined by the angles of a right triangle. They also know and are able to use elementary relationships between them. For example, $\tan(x) = \sin(x)/\cos(x)$, $(\sin(x))^2 + (\cos(x))^2 = 1$.

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- MG19.0 – Pg. 43: Students use trigonometric functions to solve for an unknown length of a side of a right triangle, given an angle and the length of a side. **Application:** Use of sin and cos to figure the length of a side of a triangle.
- MG20.0 – Pg. 43: Students know and are able to use angle and side relationships in problems with special right triangles, such as 30-60-90 degree triangles and 45-45-90 degree triangles. **Application:** The sum of 45-45-90 degree triangles always results in the diagonal of a square.
- MT1.0 – Pg. 47: Students understand the notion of angle and how to measure it, in both degrees and radians. They can convert angles between degrees and radians.
- MT2.0 – Pg. 47: Students know the definition of sine and cosine as y - and x - coordinates of points on the unit circle and are familiar with the graphs of the sine and cosine functions. **Application:** Use of polar coordinates.
- MT15.0 – Pg. 48: Students are familiar with polar coordinates. In particular, they can determine polar coordinates of a point given in rectangular coordinates and vice versa.
- MT16.0 – Pg. 48: Students represent equations given in rectangular coordinates in terms of polar coordinates. **Application:** Convert rectangular coordinates to polar coordinates.
- MT19.0 – Pg. 48: Students are adept at using trigonometry in a variety of applications and word problems. **Application:** Definitely in variety of applications, not necessarily in word problems.
- MMA1.0 – Pg. 49: Students are familiar with, and can apply, polar coordinates and vectors in the plane. In particular, they can translate between polar and rectangular coordinates and can interpret polar coordinates and vectors graphically.

Science Content Standards

SPS1b – Pg. 26: Students know that average speed is the total distance traveled divided by the total time elapsed and that the speed of an object along the path traveled can vary.

SPS1c – Pg. 26: Students know how to solve problems involving distance, time, and average speed.

SPS1f – Pg. 26: Students know how to interpret graphs of position versus time and graphs of speed versus time for motion in a single direction.

SPS2b – Pg. 26: Students know when an object is subject to two or more forces at once, the result is the cumulative effect of all the forces.

SPS2d – Pg. 27: Students know how to identify separately the two or more forces that are acting on a single static object, including gravity, elastic forces due to tension or compression in matter, and friction.

SPS3a – Pg. 27: Students know the structure of the atom and that it is composed of protons, neutrons, and electrons.

SPS3f – Pg. 27: Students know how to use the periodic table to identify elements in simple compounds.

SPT7c – Pg. 29: Students know substances can be classified by their properties, including their melting temperature, density, hardness, and thermal and electrical conductivity.

SP1d – Pg. 31 Students know that when one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction (Newton's third law).

SP1g – Pg. 31: Students know circular motion requires the application of a constant force directed toward the center of the circle.

SC1a – Pg. 36: Students know how to relate the position of an element in the periodic table to its atomic number and atomic mass.

SC1b – Pg. 36: Students know how to use the periodic table to identify metals, semimetals, nonmetals, and halogens.

SIE1b – Pg. 52: Identify and communicate sources of unavoidable experimental error.

SIE1c – Pg. 52: Identify possible reason for inconsistent results, such as sources of error or uncontrolled conditions.

SIE1l – Pg. 52: Analyze situations and solve problems that require combining and applying concepts from more than one area of science.

Social Science-History Content Standards

Grade 8:

SSHG8.4.4 – Pg. 35: Discuss daily life, including traditions in art, music, and literature, of early national America (e.g., through writings by Washington Irving, James Fenimore Cooper).

SSHG8.6.1 – Pg. 35: Discuss the influence of industrialization and technological developments on the region, including human modification of the landscape and how physical geography shaped human actions (e.g., growth of cities, deforestation, farming, mineral extraction).

SSHG8.6.2 – Pg. 35: Outline the physical obstacles to and the economic and political factors involved in building a network of roads, canals, and railroads (e.g., Henry Clay's American System).

SSHG8.10.2 – Pg. 37: Trace the boundaries constituting the North and the South, the geographical differences between the two regions, and the differences between agrarians and industrialists.

SSHG8.12.1 – Pg. 38: Trace patterns of agricultural and industrial development as they relate to climate, use of natural resources, markets, and trade and locate such development on a map.

SSHG8.12.4 – Pg. 38: Discuss entrepreneurs, industrialists, and bankers in politics, commerce, and industry (e.g., Andrew Carnegie, John D. Rockefeller, Leland Stanford).

SSGH8.12.9 – Pg. 39: Name the significant inventors and their inventions and identify how they improved the quality of life (e.g., Thomas Edison, Alexander Graham Bell, Orville and Wilbur Wright).

Grades 9–12

SSH10.3.2 – Pg. 43: Examine how scientific and technological changes and new forms of energy brought about massive social, economic, and cultural change (e.g., the inventions and discoveries of James Watt, Eli Whitney, Henry Bessemer, Louis Pasteur, Thomas Edison).

SSH10.3.3 – Pg. 43: Describe the growth of population, rural to urban migration, and growth of cities associated with the Industrial Revolution.

SSH10.3.4 – Pg. 43: Trace the evolution of work and labor, including the demise of the slave trade and the effects of immigration, mining and manufacturing, division of labor, and the union movement.

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SSH10.3.5 – Pg. 43: Understand the connections among natural resources, entrepreneurship, labor, and capital in an industrial economy.

SSH11.1.4 – Pg. 47: Examine the effects of the Civil War and Reconstruction and of the industrial revolution, including demographic shifts and the emergence in the late nineteenth century of the United States as a world power.

SSH11.2.1 – Pg.48: Know the effects of industrialization on living and working conditions, including the portrayal of working conditions and food safety in Upton Sinclair's *The Jungle*.

SSH11.2.2 – Pg. 48: Describe the changing landscape, including the growth of cities linked by industry and trade, and the development of cities divided according to race, ethnicity, and class.

SSH11.2.5 – Pg. 48: Discuss corporate mergers that produced trusts and cartels and the economic and political policies of industrial leaders.

SSH11.5.7 – Pg. 50: Discuss the rise of mass production techniques, the growth of cities, the impact of new technologies (e.g., the automobile, electricity), and the resulting prosperity and effect on the American landscape.

SSH11.7.6 – Pg. 51: Describe major developments in aviation, weaponry, communication, and medicine and the war's impact on the location of American industry and use of resources.

SSH11.8.7 – Pg. 51: Describe the effects on society and the economy of technological developments since 1945, including the computer revolution, changes in communication, advances in medicine, and improvements in agricultural technology.

SSE12.2.1 – Pg. 59: Understand the relationship of the concept of incentives to the law of supply and the relationship of the concept of incentives and substitutes to the law of demand.

SSE12.2.2 – Pg. 59: Discuss the effects of changes in supply and/or demand on the relative scarcity, price, and quantity of particular products.

SSE12.2.3 – Pg. 59: Explain the roles of property rights, competition, and profit in a market economy.

SSE12.2.5 – Pg. 59: Understand the process by which competition among buyers and sellers determines a market price.

SSE12.2.7 – Pg. 59: Analyze how domestic and international competition in a market economy affects goods and services produced and the quality, quantity, and price of those products.

SSE12.2.8 – Pg. 59: Explain the role of profit as the incentive to entrepreneurs in a market economy.

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SSE12.3.1 – Pg. 60: Understand how the role of government in a market economy often includes providing for national defense, addressing environmental concerns, defining and enforcing property rights, attempting to make markets more competitive, and protecting consumers' rights.

SSE12.4.2 – Pg. 60: Describe the current economy and labor market, including the types of goods and services produced, the types of skills workers need, the effects of rapid technological change, and the impact of international competition.

SSE12.4.3 – Pg. 60: Discuss wage differences among jobs and professions, using the laws of demand and supply and the concept of productivity.